ORIGINAL RESEARCH

Efficacy of Critical Incident Monitoring for Evaluating Disaster Medical Readiness and Response During the Sydney 2000 Olympic Games

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Abbreviations:
MCI = multiple casualty incidents

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Abstract

Introduction: Multiple casualty incidents (MCI) are infrequent events for medical systems. This renders audit and quality improvement of the medical responses difficult. Quality tools and use of such tools for improvement is necessary to ensure that the design of medical systems facilitates the best possible response to MCI.

Objective: To describe the utility of incident reporting as a quality monitoring and improvement tool during the deployment of medical teams for mass gatherings and multiple casualty incidents.

Methods: Voluntary and confidential reporting of incidents was provided by members of the disaster medical response teams during the period of disaster medical team deployment for the 2000 Sydney Olympic Games. Qualitative evaluations were conducted of reported incidents. The main outcome measures included the nature of incident and associated contributing factors, minimization factors, harm potential, and comparison with the post-deployment, cold debriefings.

Results: A total of 53 incidents were reported. Management-based decisions, poor or non-existent protocols, and equipment and communication-related issues were the principal contributing factors. Eighty nine percent of the incidents were considered preventable. A potential for harm to patients and/or team members was documented in 58% of reports, of which 76% were likely to cause at least significant harm. Of equipment incidents, personal protective equipment (33%), medical equipment (27%), provision of equipment (22%), and communication equipment (17%) predominated. Personal protective equipment (50%) was reported as the most frequent occupational health and safety incident followed by fatigue (25%). Predeployment planning was the most important factor for future incident impact minimization.

Conclusions: Incident monitoring was efficacious as a quality tool in identifying incident contributing factors. Incident monitoring allowed for greater systems evaluation. Further evaluation of this quality tool within different disaster settings is required.

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Introduction

Disasters and major multiple casualty incidents (MCI) are infrequent events for medical systems. The paucity of such events makes audit and quality improvement of the medical responses difficult. Quality improvement is necessary to ensure the design of medical systems facilitates the best possible response to such unpredictable events. Quality methods used have consisted mostly of post-event audits of unexpected incidents, or responses that deviated from the pre-event plans. In the past, such methods consisted of a post-

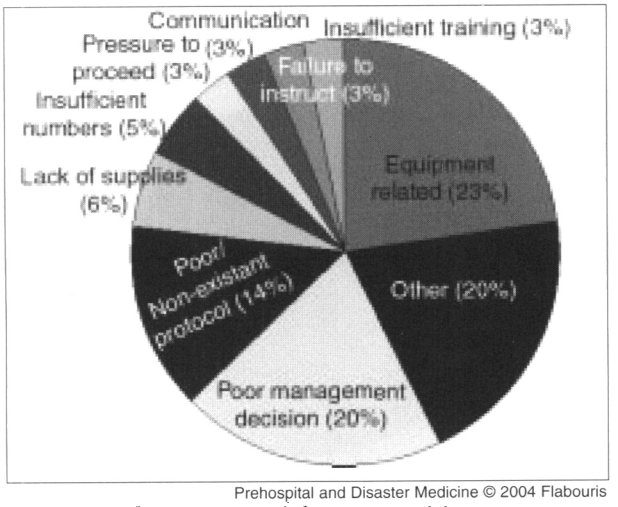

Figure 1—Categories and frequency of factors contributing to the reported incidents

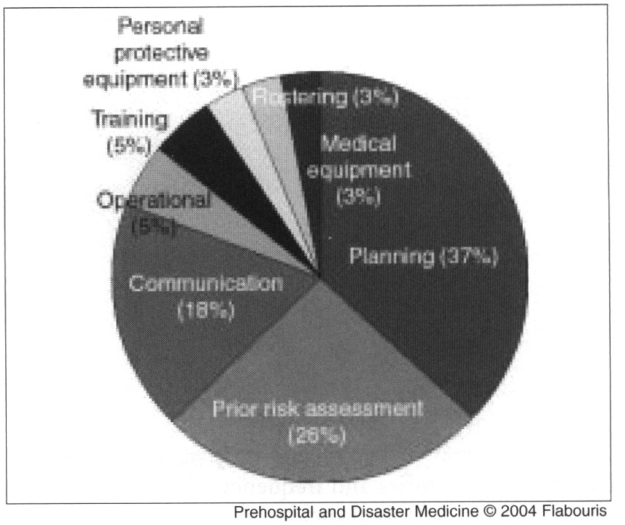

Figure 2—Categories and frequency of factors contributing to incidents reported on the two occasions of medical team activation

disaster debriefing. Additionally, analysis of surrogate markers of successful patient and scene management, such as the incidence of potentially preventable deaths,[1,2] delays in initiation of clinical care and transport at the scene,[2] and secondary interhospital patient transfer rates,[3] have been analyzed.

Critical incident monitoring was used first as a quality tool for reducing the loss of military pilots and aircraft,[4] and since has expanded to critical care areas[5–8] and more recently to out of hospital patient transportation.[9] The voluntary and anonymous reporting of incidents as compared to reporting of just accidents has the advantage of generating a larger pool of data for analysis, and potentially of identifying hazardous situations or processes before actual harm has occurred. It allows for all levels of personnel to participate and contribute to the quality improvement processes. Reported incidents can be analyzed in a near real-time fashion, collated centrally, and the same methodology can be utilized to assess quality initiated process changes.

The purpose of this study was to evaluate the utility of incident reporting as a quality improvement tool during the deployment of dedicated Medical Disaster Response Teams during the 2000 Sydney Olympic Games.

Materials and Methods

During the Sydney 2000 Olympic Games, the New South Wales (NSW) Health Services major incident and disaster plan, "NSW HealthPlan",[10] was activated. In addition to HealthPlan arrangements, six disaster medical response teams were created, largely from staff provided from within the NSW public hospital system. Team composition varied from one doctor with three nurses to a maximum of two doctors and three nurses. The role of the teams was to provide immediate medical support for any multiple casualty incidents within NSW during the period of the Games.

Each team was positioned at one of two pre-selected Sydney hospitals and was on immediate standby for 14 hours, during each of the 16 days of the Sydney Olympic Games, plus the two days prior to the Opening Ceremony. Overnight, the two teams were co-located at a third hospital on a delayed response footing. A nine-day training period preceded the deployment period. During this training period, instruction was provided to all team members including the medical and nursing commanders, as to the process of incident reporting. Incidents were defined as any event that led to, or had the potential to cause, a change in the degree of safety of either patients and/or team members. It was stressed that incident reporting did not replace any other quality assessment activities in which team members may be expected to participate. Incidents were recorded on forms that were developed in conjunction with the Australian Patient Safety Foundation for Medical Retrieval Incident Monitoring. The forms consisted of a free narrative section and sections with directed queries. Reporting of the incidents was voluntary and anonymous, with all personal identifying features excluded from subsequent analysis. Completed forms were placed in designated envelopes at each of the sites where teams were based. The forms were collected at the end of the team deployment period.

The teams' activities during the period of incident reporting involved setting up at the two hospital sites, checking equipment, establishing communication links, developing team procedures, individual team exercises, and two occasions of team deployment.

A "cold" debriefing was held two weeks post stand-down of the Sydney Olympic Disaster Medical Response Teams. At that time, each team leader provided a 10-minute verbal report of their team's experience. Adverse issues, as highlighted by the team leaders, were collectively recorded for comparison with those documented on the Incident Report Forms.

A database specific to this study was developed. The authors collectively reviewed the free narrative section of

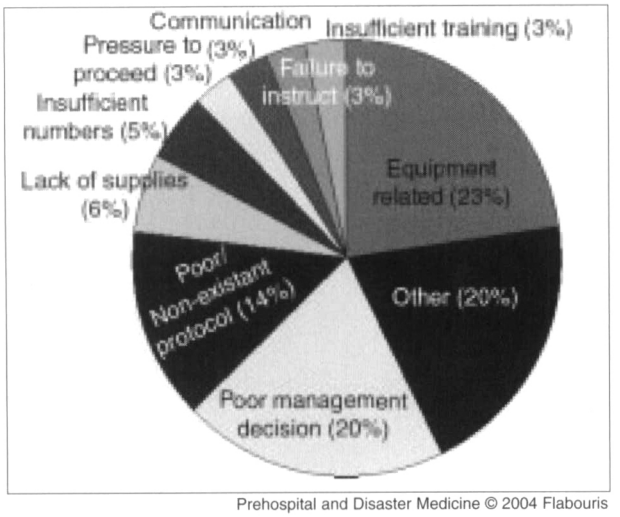

Figure 3—Reported incident contributing factors considered to have the potential for causing at least significant patient or team member harm

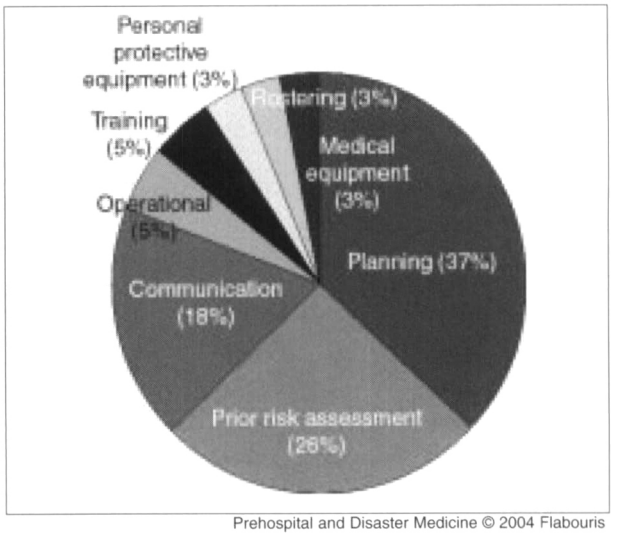

Figure 4—Factors, as documented by the team member reporting the incident, considered to have the potential for minimising the adverse consequences of reported incidents

the forms and a consensus was reached as to the classification of the information provided. Descriptive statistical techniques were used for all subsequent analysis.

Results

Thirty-five incident report forms were completed and returned, for a total of 53 incidents. Twelve (33%) of the forms recorded more than one incident. Medical team leaders (including the authors) completed 21 (59%) of the incident report forms. Other medical team members completed 10 (29%), and nursing team members completed 4 (12%). During the time teams were operational there were two team activations, which generated 6 (17%) incident reports.

The first of the team activations was to the release of a hazardous substance, later identified as a volatile cleaning agent, through the air-conditioning system at Sydney International Airport, two days prior to the Games' Opening Ceremony. The team was stood down before they were able to leave their base hospital, due to delays caused by inadequate transport arrangements. The second was deployment of one team to a hospital Emergency Department, which was predicted to receive an extraordinarily large number of patients associated with Closing Ceremony celebrations. The second team on duty also was dispatched to assist this hospital when it was clear that large numbers of casualties were presenting, but due to transportation delays, it arrived at the hospital after all casualties had been treated and released.

The frequency of categories of the factors that contributed to documented incidents are illustrated in Figure 1. Management-based decisions, poor or non-existent protocols, equipment, and communication-related issues predominated. The categories of factors contributing to incidents that were documented during the two occasions of team deployment are illustrated in Figure 2. Incidents relating to the interaction of the medical team with other scene emergency services and the designated scene commander were unique to the deployment situations.

Incident reporters deemed that 89% of all of the incidents reported were preventable. A potential for harm to patients and/or team members was documented in 21 (58%) reported incidents. Incidents associated with personal protective equipment were the most frequently documented equipment incidents (33%), followed by problems with medical equipment (27%), inadequate provision of equipment (22%), and communication-related equipment (17%). Personal protective equipment (50%) was reported as the most frequent occupational health and safety-related incident followed by fatigue (25%) (Figure 3). Of communication related incidents, 20% were related directly to communication equipment, 67% to organizational-vertical and 13% to organizational-horizontal communication.

Recommendations for ways in which the incident may be better managed or prevented in the future were provided in 22 (61%) forms. These are illustrated in Figure 4. Documented factors that were considered to have minimized the incident were recorded in 10 (28%) forms. Of these, "good luck" (80%) was the predominate factor followed by team member expertise (10%) and low probability of consequence occurrence (10%).

Contributing factors that were reported by the incident monitoring methodology and those described as adverse events at the time of the Sydney Olympic Disaster Medical Response "cold" debrief, held two weeks after the teams were stood down, are listed in Table 1.

In a departmental report summarizing the health services activities, there were no reported patient- or staff-related injuries during the study period.[11]

Discussion

The results of this study indicate that the critical incident

Incidents Documented Through Incident Monitoring Process	Incidents Documented at Cold Debrief Session
Communication	Communication problems
Equipment-related	Equipment-related
Insufficient training	Insufficient training
Failure to instruct	Fatigue
Fatigue	Time for preperation
Haste	Staffing - prior experience
Insufficient numbers	Poor risk assessment
Failure to provide/enforce	Poor planning/preparation
Lack of supplies	Poor protocols/procedures
Lack support system	Management decisions
Poor management decision	Failure to consult
Poor/Non-existent protocols	Documentation
Pressure to proceed	Time for preparation
Short cut	Management decisions
Team-related	Clarification of team roles
Unfamiliarity with equipment/environmental	Transportation of teams
	Interaction with other services
	Rosters/Duty hours

Table 1—Comparison of incidents reported on the Incident Report Forms with the adverse issues raised by the team leaders at the "cold" debrief.

monitoring technique is applicable as a quality improvement activity during deployment for mass gatherings. Management-based decisions, failure or absence of appropriate protocols, equipment-related and communication issues were the categories most often reported for factors contributing to incident occurrence. The prominence of management and communication incidents highlights the value of an anonymous avenue to highlight system factors that otherwise might not be noted.

For the management category, planning and poor risk assessment were the principal contributors. For communication factors, equipment alone contributed only to 20% of the problems; with the largest problem being the vertical communication within the organizational hierarchal structure. This reinforces the previous finding that while communication problems are frequently reported during major incidents, they generally are the symptomatic manifestation of an organizational error rather than a communication equipment issue.[12]

Managerial, protocol/policy, and equipment factors were to be the most often identified factors considered amenable to mitigation. These factors also were major contributors to incident occurrence, and had substantial harm potential, emphasizing the importance of the planning and preparation phase for major incident management. Planning and testing of policy and procedures must be based upon an adequate risk assessment. Other factors to be addressed during the planning and preparation phase include equipment selection, testing and supply, communication equipment and channels, team training, level of seniority and performance, interaction with other services, and the nature and function of the managerial structure that will oversee it.

Not all of the incidents reported through incident monitoring matched those reported at the debriefing. Thus, incident monitoring may not necessarily be a replacement for the debriefing. The critical incident monitoring technique to be complimentary to the post-incident debriefing and is useful as a quality activity as it documented problems not identified using the traditional methods.

Critical incident reporting allows all personnel such as doctors, nurses, and other ancillary staff to participate and contribute to the quality improvement process. Team debriefing sessions record team-specific incidents, but fail to benefit from the enhanced analysis that arises from the greater volume of information that occurs with central collation of all of the teams' contributions. Incident reporting potentially can capture data in real time, which otherwise may be forgotten by the time a cold debriefing is held. Organizational debriefings, especially in large, complex systems that characterize disaster readiness, may not provide the opportunity for inclusion of all individuals. However, incident reporting is more inclusive. Anonymous reporting of incidents also allows the recording of information that otherwise may not be politically possible.

No patient- or staff-related injury was reported in relation to this event. If reportable accidents alone had been sought and analyzed, no such information would have been reported. As errors, the nature of which we seek to identify and prevent, are more likely to result in incidents as compared to accidents, performing incident monitoring will provide a greater amount of error-related information as compared to the much less frequent and thus, less often reported accident events.[13]

Weaknesses of this study were that only the period the medical teams were on duty was included and that there was a low frequency of actual team deployment. Preparation, planning, and responding to major events is multifaceted, has multi-service input, and begins long before actual deployment. This study was limited to the

medical and nursing component of that response, and other emergency services that are administered separately were not included.

Similar incidents to those reported here also have been cited in reports on previous major incidents. These included poor or non existent appropriate protocols or insufficient training that resulted in teams working in inappropriate environments,[14–21] inadequate personal protective equipment,[14,15,17,18,21–26] inadequate transport arrangements[27] and communications.[17,22,25,27–31] This suggests some commonality with other types of events, and that the technique may have external validity. This should be confirmed by utilization of the technique in other incident types.

Conclusion

Incident monitoring methodology can be applied to multiple casualty incidents and mass gatherings, and is qualitatively similar and complimentary to the traditional post-incident debriefings. Central collation of reported incidents has unique advantages for the identification and development of quality improvement measures and monitoring of systems improvements. It also may better identify system-based incident contributors. Consideration should be given to broader testing of this methodology within a variety of disaster medical settings. As disasters occur infrequently, this would be achieved best through international collaboration.

Acknowledgement

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